

REMARKS

Claims 1-23 are pending in the application. Claims 1, 18, and 21 are the only independent claims.

Claims Rejections - 35 U.S.C. §§ 102 and 103

Claims 1-3, 5-9, 11, 12, and 15-20 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 3,473,661 to Duff.

Claims 18-21 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 2,473,297 to Parker.

Claims 1-4, 6-11, 13, 16, and 17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Parker in view of U.S. Patent No. 2,253,878 to Weber.

Claims 18-22 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 2,370,356 to Kamp et al. or U.S. Patent No. 4,392,955 to Soriente.

Claims 18-23 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 3,353,676 to Hirsch.

The Examiner has indicated that claim 14 would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

Claim 1 Applicant respectfully traverses the rejections of claim 1 under 35 U.S.C. §§ 102 and 103 and maintains that claim 1 distinguishes the invention over the prior art relied on by the Examiner.

As set forth in claim 1, a thickener/clarifier comprises a vessel, an overflow launder, an underflow discharge port, a deliquifying member, and a rake assembly. The vessel has an inlet for receiving a slurry of a liquid and solid particles suspended in the liquid. The vessel also has an upper portion holding a free settling zone having a relatively low concentration of solid slurry particles, a lower portion holding a compaction zone having a relatively high concentration of solid slurry particles, and a hindered settling zone between the compaction zone and the free settling zone, with the compaction zone and the hindered settling zone constituting lower settling zones. The overflow launder is disposed adjacent the upper end of the vessel for discharge of an

overflow phase of the slurry that has been separated in the vessel. The underflow discharge port is adjacent the bottom of the vessel for discharge of a thickened, underflow phase of the slurry that has been separated in the vessel. The deliquifying member extends in the vessel, up from the lower portion of the vessel to the upper portion of the vessel for flow of liquid from at least one of the lower settling zones to the free settling zone while isolating the flow of liquid from the flow of slurry down in the lower settling zones. The rake assembly is mounted for rotation in the lower portion of the vessel, with the rake assembly having at least one elongated generally vertical picket forming channels in the slurry held in the lower portion of the vessel for releasing liquid in at least one of the lower settling zones to flow to the deliquifying member and on to the free settling zone.

In brief, none of the references of record, whether considered singly or in combination with one another, either discloses or suggests a thickener/clarifier wherein (A) a deliquifying member extends upwardly in a vessel from a lower portion to an upper portion thereof for flow of liquid from a lower settling zone to a free settling zone while isolating the flow of liquid from the flow of slurry down in the lower settling zone and (B) a rake assembly in a lower part of the vessel has at least one elongated generally vertical picket forming channels in the slurry held in the lower portion of the vessel for releasing liquid in a lower settling zone to flow to the deliquifying member and on to the free settling zone.

Duff simply discloses a sedimentation and filtration combination device for removing suspension solids from liquids which uses a directionalized/channellized influent feed system utilizing various baffles (34, 36, 38, 42, 43 and 44) and cylindrical walls (24 and 26) to maintain flow within an upper zone of the sedimentation vessel (13), while keeping the lower zone of the sedimentation vessel, generally below the level of the lower baffles (36 and 43), in a relatively quiescent state (see, e.g., Duff at Column 3, lines 19-48).

Inclined elements (43) prevent "[t]he introduction of turbulence into the lower portion of the sedimentation vessel 13" (Column 3, lines 23-29) and thereby "permit the sedimentation of solids to the bottom of the vessel 13" (Column 3, lines 42-44). In no way do these or any other

inclined baffles or elements such as the cylindrical walls (24 and/or 26) of the Duff reference allow for or facilitate the flow of liquid from lower hindered settling and/or compaction zones to an upper free settling zone of the vessel, such as clearly described in the present specification, shown in the accompanying figures and specifically claimed in the independent claim 1.

Furthermore, Duff's disclosure of lower scraper or bar 22 including a plurality of upright or vertical pickets (102) also clearly does not anticipate or disclose the present invention as claimed. The pickets (102) of Duff are specifically considered and called out as "thickening" pickets, which are simply used as an "aid in the collection and thickening of particulate material, while the rotation prevents thixotropic gelation" (Column 5, lines 22-27). These pickets are clearly quite short and fully contained in the lower, quiescent portion of the sedimentation vessel (13) as distinctly shown in Fig. 1 of Duff and in no way do they extend out of this lower, quiescent portion of the vessel into the upper zone, generally located above the baffles 36 and 43.

With regard to Parker, this reference simply discloses a clarifier including a tank (1) with distinct individual clarifying zones or cells (22) and a centrally mounted clear liquor standpipe (11) clearly leading to the outside of the tank or vessel (1) by way of a fitting (16) and a pipe (17), both the zones (22) and standpipe (11) being mounted well above the lower sludge mixing compaction and collection area (39). As such, Parker does not disclose, among other elements of the present invention as claimed in claim 1, a deliquifying member extending from a lower, hindered settling or compaction zones of a vessel to an upper, free settling zone of the vessel or a deliquifying member for isolating the flow of liquid from the flow of slurry down in the lower settling zones, or a rake and picket assembly to facilitate the release of liquid in at least one of the lower settling zones to flow to said deliquifying member and on to a free settling zone.

Weber discloses a tray clarifier having a central tubular column (26) for conveying flocculant liquid downwardly into a plurality of settling or sedimentation compartments (B, C, D, E). Clarified liquid is drawn off from the settling compartments via draw-off pipes (23), while settled sludge is removed from horizontal dished trays (22) via rake arms (51) and scrapers (52), the sludge being impelled into and cascading down central tray openings (45). A picket fence

thickening mechanism disposed at the bottom (12) of the clarifier tank (10) has upwardly extending palings or stirrers (55) that produce voids which permit the upflow from the sludge blanket of entrapped liquid released by the stirring action of the palings.

Neither Parker nor Weber discloses or suggests a deliquifying member extending upwardly in a vessel from a lower portion to an upper portion thereof for flow of liquid from a lower settling zone to a free settling zone while isolating the flow of liquid from the flow of slurry down in the lower settling zone. In Parker, the centrally mounted clear-liquor standpipe (11) does not communicate at its upper end with the upper part of the tank and is therefore lacks the claimed structure. The central column (26) of the Weber tray clarifier serves to guide flocculant liquid downwardly from an upper flocculation or feed compartment (A) to intermediate settling compartments (B-E). Thus, the combination of Parker and Weber does not provide one of ordinary skill in the art with the teachings to arrive at the invention as set forth in claim 1.

Claim 18 Applicant respectfully contravenes the Examiner's rejections of claim 18 under 35 U.S.C. §§ 102 and 103 and contends that claim 18 distinguishes the invention over the prior art relied on by the Examiner.

As recited in claim 18, a method of operating a thickener/clarifier having an upper portion and a lower portion comprises (a) feeding a slurry of a liquid and solid particles suspended in the liquid into a vessel, and (b) separating the slurry by gravity into different zones having respective degrees of liquid-solids separation including at a upper portion of the vessel, a free settling zone having a relatively low concentration of solid slurry particles and further including, at a lower portion of the vessel, a compaction zone having a relatively high concentration of solid slurry particles and a hindered settling zone between the free settling zone and the compaction zone, with the hindered zone and the compaction zone constituting lower settling zones. The method additionally comprises (c) discharging an overflow phase of the slurry that has been separated in the vessel into an overflow launder adjacent to an upper end of the vessel, (d) discharging, via an underflow discharge adjacent a bottom of the vessel, a thickened, underflow phase of the slurry

that has been separated in the vessel, (e) directing liquid from at least one of the lower settling zones to flow up to the free settling zone via a flow path isolated from the flow of the slurry down in the vessel in the lower settling zones, and (f) forming generally upwardly, extending channels in the slurry held in the lower portion of the vessel to release liquid in at least one of the lower settling zones to flow to the isolated flow path and then on to the free settling zone.

None of the references relied on by the Examiner, whether viewed one by one or together with one another, either discloses or suggests a method of operating a thickener/clarifier wherein (i) liquid is directed from at least one of two lower settling zones to flow up to a free settling zone via a flow path isolated from the flow of slurry down in the thickener/clarifier vessel in the lower settling zones and (ii) generally upwardly extending channels are formed in the slurry held in the lower portion of the vessel to release liquid in at least one of the lower settling zones to flow to the isolated flow path and then on to the free settling zone.

As discussed above, Duff provides a sedimentation and filtration device wherein inclined baffle elements 43 prevent the flow of liquid from a lower settling zone to an upper free settling zone. Moreover, the thickening pickets (102) disposed at the bottom of the sedimentation vessel (13) aid in the collection and thickening of particulate material by preventing thixotropic gelation. The thickening pickets (102) do not form upwardly extending channels to release liquid in a lower settling zones to flow to an isolated flow path and then on to a free settling zone. If any channels were formed of sufficient height by the operation of the thickening pickets of Duff, no liquid would find its way inside the cylindrical walls (24, 26) owing to the inclined baffles (43) blocking the upward flow.

As pointed out above, Parker discloses an apparatus for clarifying liquids, wherein a clear-liquor standpipe (11) extending from a lower end of the clarifier vessel communicates therewith but not with upper end of the vessel. The standpipe does not and cannot direct liquid from a lower settling zone to flow up to a free settling zone. Parker has no isolated flow path. Accordingly, the method of claim 18 is not performed during utilization of the apparatus of Parker.

Kamp discloses a liquid treatment apparatus wherein liquid is conveyed up a central tube (18) via injected air and is directed along generally radially extending conduits (24) to an annular outer flocculation chamber (15). The liquid then spirals downwardly through the flocculation chamber and, from a lower region of the liquid treatment vessel, flows upwardly (arrows B) into an annular inner settling chamber. Thus, the apparatus of Kamp does not include a liquid flow path from a lower settling zone to an upper free settling zone isolated from a settling slurry. Like Parker, the liquid flow path defined by a central tube does not communicate with an upper free settling zone. As in Parker, operating the apparatus of Kamp does not and cannot include the directing of liquid from at least one of two lower settling zones to flow up to a free settling zone via a flow path isolated from the flow of slurry down in the thickener/clarifier vessel in the lower settling zones.

Moreover, neither Parker nor Kamp discloses or suggests forming upwardly extending channels in a slurry held in a lower portion of the respective vessel to release liquid in a lower settling zone to flow to the isolated flow path and then on to the free settling zone. Not only do Parker and Kamp fail to disclose isolated flow paths to an upper free settling zone but those references also fail to disclose the formation of upwardly extending channels that could convey released liquid to an upwardly extending isolated flow path. Both Parker and Kamp disclose generally horizontally extending scraper blades. The rotation of these blades does not and cannot generate the upwardly extending channels of claim 18.

Soriente discloses a liquid treatment apparatus having a vertical updraft tube (21) with a bottom end terminating above a rake (16) and an upper end terminating below the upper surface of the tank (11). The tube is provided with a plurality of nozzles (25) that induce the updraft of solids along the tube from the bottom of the tank. Thus, instead of forming a guide for clarified liquid from the lower part of the tank to the upper part of the tank, the tube (21) serves as a guide for solids. Thus, Soriente teaches away from the invention as set forth in claim 18.

Soriente also discloses a plurality of generally horizontal rakes (16). The rotation of these rakes does not and cannot form upwardly extending channels in the slurry held in the lower

portion of the vessel to release liquid in a lower settling zone to flow along the tube to the upper end of the tank.

Hirsch relates to a settling tank that has a central riser tube (Fig. 5) that, like the central tube of Soriente, conveys solids from a lower portion of a tank to an upper portion thereof. Furthermore, like Soriente, Hirsch discloses a horizontal rake that cannot generate vertical channels for the conveyance of clarified liquid along a dedicated upward flow path separated from downward flow of slurry or solids particles.

Claim 21 Applicant respectfully traverses the rejections of claim 21 under 35 U.S.C. §§ 102 and 103 and maintains that claim 21 distinguishes the invention over the prior art relied on by the Examiner.

As described in claim 21, a thickener/clarifier comprises a vessel, an overflow launder, an underflow discharge port, a deliquifying member, and an injector. The vessel has an inlet for receiving a slurry of a liquid and solid particles suspended in the liquid. The vessel also has an upper portion surrounding a free settling zone having a relatively low concentration of solid slurry particles, a lower portion surrounding a compaction zone having a relatively high concentration of solid slurry particles, and a hindered settling zone between the compaction zone and the free settling zone, with the compaction zone and the hindered settling zone constituting lower settling zones. The overflow launder is disposed adjacent the upper end of the vessel for discharge of an overflow phase of the slurry that has been separated in the vessel. The underflow discharge port is disposed adjacent the bottom of the vessel for discharge of a thickened, underflow phase of the slurry that has been separated in the vessel. The deliquifying member extends in the vessel up from the lower portion of the vessel to the upper portion of the vessel for flow of liquid to the free settling zone from at least one of the lower settling zones while isolating the flow of liquid from the flow of slurry down in the lower settling zones. The injector serves

for injecting flocculant into the flow of water to the free settling zone to facilitate settling of solid particles in the water.

None of the references of record, whether considered singly or in combination with one another, either discloses or suggests a thickener/clarifier wherein a deliquifying member extends upwardly in a vessel from a lower portion to an upper portion thereof for flow of liquid from a lower settling zone to a free settling zone while isolating the flow of liquid from the flow of slurry down in the lower settling zone.

Again, Parker discloses an apparatus for clarifying liquids, wherein a clear-liquor standpipe (11) extending from a lower end of the clarifier vessel communicates therewith but not with upper end of the vessel. At its upper end, the standpipe is closed to the upper end of the clarifier vessel and instead extends outside of the vessel. The standpipe does not and cannot direct liquid from a lower settling zone to flow up to a free settling zone. Parker has no isolated flow path. Accordingly, the apparatus of claim 21 is not anticipated by or obvious from Parker.

In the liquid treatment apparatus of Kamp, a central tube (18) for conveying liquid impelled by injected air is closed to an upper end of a settling chamber and instead communicates with an upper end of an annular outer flocculation chamber (15) via generally radially extending conduits (24). Thus, the central tube (18) of the liquid treatment apparatus of Kamp does not define a liquid flow path from a lower settling zone to an upper free settling zone isolated from a settling slurry.

In the liquid treatment apparatus of Soriente, a vertical updraft tube (21) has a bottom end terminating above a rake (16) and an upper end terminating below the upper surface of the tank (11). The tube is provided with a plurality of nozzles (25) drawing solids along the tube from the bottom of the tank. Thus, the vertical updraft tube (21) of Soriente is not a guide for clarified

liquid from the lower part of the tank to the upper part of the tank, but rather a guide for solids.

Thus, Soriente does not anticipate the invention as set forth in claim 21.

In the settling tank of Hirsch, a central riser tube (Fig. 5), like the central tube of Soriente, conveys solids from a lower portion of a tank to an upper portion thereof.

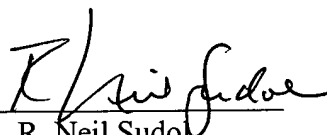
Conclusion

For the foregoing reasons, independent claims 1, 18, and 21, as well as the claims dependent therefrom, are deemed to be in condition for allowance. An early Notice to that effect is earnestly solicited.

Should the Examiner believe that direct contact with applicant's attorney would advance the prosecution of this application, the Examiner is invited to telephone the undersigned at the number below.

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